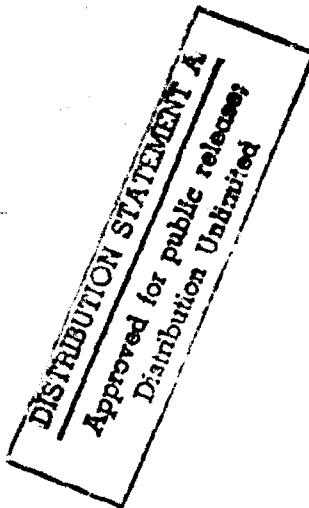


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GROUP COMPATIBILITY IN RESTRICTED ENVIRONMENTS

E. K. ERIC GUNDERSON

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13. ABSTRACT Likeability and compatibility are considered important concepts in predicting group effectiveness in isolated environments. In the Antarctic setting group compatibility and group accomplishment are highly related. Formality of group structure had a nonlinear relationship with group compatibility; groups which were either clearly formal or informal were more compatible than groups of apparently ambiguous or inconsistent structure. Analyses of the interactions of role, personality, and group attributes in predicting group compatibility have suggested useful approaches to study of the group assembly problem in isolated environments.			

**APA SYMPOSIUM ON FACTORS AFFECTING TEAM
PERFORMANCE IN ISOLATED ENVIRONMENTS**

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**S. B. SELLS, PH.D.
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Group Compatibility in Restricted Environments

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The effectiveness of teams and small autonomous work groups depends to some degree upon the existence of mutually positive attitudes among members. Other factors, notably motivations and abilities of group members and relevant environmental conditions, presumably influence group performance as well. If it is true that compatibility generally exerts a facilitating influence upon group efforts, investigation of the antecedents and correlates of group compatibility should improve understanding of the determinants of group effectiveness.

This report will summarize studies of group compatibility conducted at isolated scientific stations in Antarctica. Antarctic groups undergo a unique degree of confinement and isolation from the outside world and typically show some deterioration in group compatibility and accomplishment during the long winter.

The Antarctic continent is the most hostile environment inhabited by man. Approximately 35-40 scientists and 250-300 Navy men carry out scientific projects at five U.S. stations. This program is administered by the National Science Foundation and is logistically supported by the U.S. Navy. The Navy's Bureau of Medicine and Surgery provides medical support for Antarctic operations, including physical and psychiatric

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examinations of applicants, medical care in Antarctica, and research on the physiological and psychological effects of this environment.

Biographical data, psychological tests, and personality ratings are obtained for all applicants prior to deployment to Antarctica. Questionnaire and rating data collected on two occasions during the Antarctic winter provide a variety of criterion measures. Dependent variables of principle interest in this review are various indicators of individual likability and of group compatibility and the antecedent and concurrent correlates of such measures.

Station Environments

Essential features of small Antarctic stations are the following:

(1) station groups range in size from 8 to 25 men, (2) groups are formed de novo and remain at stations for one year, (3) groups are composed of a wide variety of occupational specialities, (4) stations are completely isolated from the outside world for eight to nine months, and (5) activities are greatly restricted at the stations during the long Antarctic winter (about six to eight months) because of the severe climate and darkness.

The five U.S. stations currently occupied year-round are McMurdo, Byrd, Palmer, Plateau, and South Pole. Studies have also been conducted at Eights and Hallett Stations which no longer operate through the winter months. Distinctive features of each station will be summarized briefly.

McMurdo, the largest station with a wintering party of about 250 men, is the major staging and supply base for Navy logistic operations. McMurdo,

except for the extreme climatic conditions, enjoys many of the advantages of a typical military establishment with varied recreational facilities.

A nuclear reactor supplies adequate power, heat, and distilled water for a small city. At the smaller stations conditions are strikingly different. Space and physical facilities are very limited. Station members live and work in close proximity and many normal activities and sources of stimulation typically present in larger groups are not available.

Byrd Station is located on the inland ice cap at an elevation of about 5,000 feet above sea level. The station consists of prefabricated buildings placed in long tunnels 40 feet deep, roofed over with steel arches overlaid with packed snow. The station is supplied by air during the summer months and is maintained during the winter by a complement of 18 Navy men and a scientific party of about nine men.

Eight Station, located near the base of the Antarctic Peninsula at about 1,400 feet above sea level, was a temporary camp consisting of portable buildings transported to the site by large aircraft. The station operated year-round from 1963-65. Living and working conditions were difficult at this station.

Hallett Station, located near McMurdo, was supplied by sea and air. Buildings are all on the surface, and the climate is less severe than at most other stations. This station was jointly operated with New Zealand. About 10 Navy men and four scientists made up the winter party.

Palmer Station on the Antarctic Peninsula, near South America, can

(be reached only by ship. Four Navy and five scientists make up the station complement. Because of its coastal location, biological studies are emphasized. Climatic conditions are less extreme at Palmer than at other stations.

Plateau Station consists of five portable vans linked together. It is located in an inaccessible region high on the Polar Plateau at an altitude of almost 12,000 feet above sea level. Plateau Station and Russia's Vostok Station share the distinction of having the most extreme environmental conditions of any inhabited spots on the earth. Plateau Station was operating under emergency conditions during part of the past year and, unfortunately, research data were not collected at that station.

South Pole Station is at the geographical South Pole at an elevation of approximately 9,200 feet above sea level on the inland ice cap. The average annual temperature at the South Pole is -57°F . South Pole Station has typically 13 Navy men and seven scientists and meteorologists in the winter party.

During the summer months, station members work very hard on construction, repairs, and storage of supplies to prepare for the long winter ahead. During the six to eight months of severe weather and darkness, station personnel are forced indoors and activities are very limited. The most critical aspect of life at any small station is the fact that after the onset of winter there is no possibility of evacuation or of obtaining outside help. Contact with the outside world is restricted to radio communications

and, at times, even radio communication is not possible. Because the men are confined to the physical boundaries of the camp, another important feature of station life is the lack of privacy and the impossibility of getting away from one's associates.

There is consistent evidence that conditions at the Antarctic small stations are mildly to moderately stressful for many participants. In all expeditions studied, the incidences of symptoms pertaining to sleep disturbances, depression, and irritability increased during the winter months. Motivation and group harmony also have tended to decline in most station groups studied.

The five stations included in the present studies differed on a number of environmental characteristics. An effort was made to indicate the relative severity of these environments for human habitation by averaging ranking on four environmental factors: altitude, average annual temperature, number of months of darkness, and square feet of building space per man. The composite ranking of stations from most to least severe environment was South Pole, Eights, Byrd, Palmer, and Hallett.

Group Composition

Antarctic station groups are composed of a wide variety of occupational and scientific specialists. Even the smallest station must have at least one man in each of the following occupations: medicine, electronics and radio communications, diesel engine maintenance and repair, and

cooking. Other occupational specialties may be included at various stations depending upon construction or scientific projects to be carried out, equipment to be operated or maintained, and available space. Scientific disciplines typically represented include meteorology, ionospheric physics, aurora, and radio science or cosmic rays.

Except for radiomen and meteorologists only one specialist from each occupation is typically present. Each man has a particular task which makes a unique contribution to the group's mission. Group members usually are required to assume duties outside their occupational specialties, including a share of the general housekeeping chores.

Because of the diversity of occupations, social and educational backgrounds of group members vary considerably, and psychological differences tend to be associated with these social background differences. For example, Navy cooks, mechanics, and equipment operators differ from scientists and naval officers on a wide range of cultural background and personality characteristics. In small closed groups certain of these differences may have adverse effects upon communication, teamwork, and accomplishment.

It is emphasized that specific work roles differ both in the kinds of tasks performed, including the amount of social interaction possible on the job, and in the amount and distribution of work over the year. Men in certain jobs, for example, heavy equipment operators, mechanics, radio operators, and hospital corpsmen, generally have less to do during

the winter than those in other occupations. Differences in the incidence of emotional symptomatology and in motivational changes are related to these work role differences. It seems clear that vulnerability to adjustment problems in this environment is dependent in some degree upon a specific job at the station.

Likeability as a Personality Trait

Likeability or social attractiveness may be an important concept in the prediction of group compatibility. Group cohesiveness often is defined as the degree of mutual liking among group members. Presumably, if one selects more likeable individuals to compose a group, a greater degree of mutual liking and compatibility might be achieved overall. Before this assumption can be seriously entertained, however, some attention must be given to likeability as a meaningful and measurable concept.

We have attempted to assess likeability or social attractiveness by several methods and have been interested in the interrelationships among these measures. One available source of data on likeability was clinical evaluations. After conducting brief interviews, a psychologist and a psychiatrist independently rated each applicant for Antarctic service on two 6-point rating scales: (1) personally likeable and (2) acceptable to peers. Low but significant agreement was present between clinicians' ratings on these two items ($r = .31$, $p < .001$, and $r = .24$, $p < .001$, respectively) for a sample of 263 Navy and civilian applicants.

Thus, the reliability of ratings of likeability or social attractiveness

by clinicians tended to be low. The independent clinical ratings were summed for each subject, however, and these combined likeability and peer acceptability scores were correlated with five measures of likeability or popularity at Antarctic stations. The five scores were (1) averaged ratings on "likeable" by supervisors; (2) averaged social attractiveness scores based upon supervisors ratings on the highly intercorrelated items "likeable," "cheerful," and "consideration of others"; (3) averaged social attractiveness scores based upon peer nominations for the item "most friendly and popular"; (4) a composite of supervisor and peer social attractiveness scores; and (5) averaged scores based upon peer nominations for the item "closest friend." Correlations between the clinicians' ratings of likeability and acceptability to peers and the supervisors' and peers' evaluations of likeability and popularity were uniformly low for the sample as a whole. When clinicians' ratings were correlated with supervisors' and peers' evaluations separately for Navy and civilian subjects, however, many significantly positive correlations were present for the civilian group while no significantly positive correlations were present for the Navy sample. In fact, correlations between clinicians' ratings and supervisors' ratings of likeability for Navy personnel were consistently negative, and two of the six correlations reached statistical significance. It seemed clear that the psychologists and psychiatrists could not assess or predict likeability at all in Navy men, but the clinicians could predict to some degree in the civilian group, a group

more similar to the clinicians in cultural background and social status. The highest correlation achieved for the civilian group was a .34 between the combined clinical rating on acceptability to peers and peer nominations on "most friendly and popular." Supervisors and peers tended to agree substantially on likeability as indicated by correlation of .54 between supervisors' ratings of "likeable" and peer nominations of "most friendly and popular." We have used a composite of the supervisor and peer evaluations as a general social attractiveness or popularity criterion, and, although clinicians' ratings generally are not helpful, a number of self-description attitude or personality scales have consistently predicted popularity. For example, high expressed motivation for the expedition, high achievement need, and a high degree of optimism, and strong needs for affection, as measured by questionnaire scales, have consistently correlated negatively with the social attractiveness criteria.

The concept of likeability as a general personality trait obviously has limited utility in assessment or prediction because of the variability in value systems of those making judgments of likeability. Our present strategy is to enhance predictions of popularity by evaluating the interactions of independent variables which reflect role, personality, and environmental or group characteristics in predicting popularity. For example, we can ask the question: "How does popularity vary with occupational role (scientist, Navy Seabee, or Navy radioman), with affection need (low, middle, or high), or with all of these factors simultaneously?" A technique developed by Dr. John Piag and Dr. Ardie Lubin

of the Navy Medical Neuropsychiatric Research Unit, San Diego, enables us to evaluate the effects of interactions among the independent variables in an analysis model that combines the regression method and the analysis of variance.

Similarity and Interpersonal Attraction

Similarity of attitude and personality needs has been shown to relate significantly to interpersonal attraction by Newcomb (1961), Byrne and Nelson (1964), and others. Lester (1965) found partial support for the proposition that this relationship tends to increase over time among members of the Mt. Everest expedition. In Antarctic groups we have examined the relationships of similarity of group members on various kinds of background and personality data to an index of mutual esteem derived from responses of all pairs of group members to seven sociometric items which reflected attraction or esteem. The mutual esteem score was number of choices given by either or both members of a pair for the other over the seven items.

Four similarity indices were obtained between all pairs of members in all Antarctic station groups. These indices were correlations between pairs of group members over item responses or scale scores. The indices were based upon four types of screening information: (1) responses to an attitude inventory, (2) expressions of liking, disliking, or neutrality for a series of hobbies and interests, (3) ratings of personality traits preferred in close friends, and (4) scores from 30 personality, need,

and attitude scales. An overall estimate of between-pair similarity was obtained by averaging the correlations representing the four separate similarity indices. For each station group, the average similarity for each pair was correlated with the mutual esteem score for that pair. Our prediction was that similarity between pairs should be significantly related to mutual esteem.

Results have varied widely over groups. While the trend is in the expected direction with predominantly positive correlations, there also are station groups with zero order and minus correlations. Our task presently is to discover the group conditions which seem to enhance the relationship between similarity and attraction. We have tested the proposition that groups which are most compatible will tend to show higher relationships between similarity and attraction and the proposition that similarity is more highly related to attraction among Navy personnel than among civilian scientists. Neither of these propositions has as yet received clear-cut support from our data, and the question of group factors that may influence the relationship between similarity and attraction remains ambiguous for the present. It may be that similarity between key group members, for example, station leaders or between group members who must interact frequently, have much more importance for predicting group compatibility than similarity among members generally.

Heterogeneity and Compatibility as Group Properties

In another approach to the problem of predicting group compatibility, heterogeneity of the group as a whole on a number of social background, attitude, and personality need variables was related to a questionnaire-derived scale of group compatibility. It seemed plausible that group tensions or conflicts might be more frequent or more pronounced in groups where members varied markedly in attitudes and values, particularly where wide differences existed on issues that were important for group maintenance or achievement. In this study the measure of group compatibility was based upon questionnaire items which described the group as a whole and which were administered to all station members after approximately six months of isolation in the Antarctic. Construction of these scales has been described elsewhere. Negative correlations between heterogeneity indices (standard deviations) and mean compatibility scores for groups would indicate that wide variation in attitudes and personality needs were detrimental to group harmony and cooperation. Heterogeneity on attitudes and values most closely related to group integrity and work achievement were considered most likely to relate significantly to compatibility.

Overall, there was a marked trend for heterogeneity to correlate negatively with group compatibility for a sample of 15 groups. Variance on age, educational level, and frequency of worship did not relate significantly to the compatibility criterion. Variance in size of community

residence (urban-rural) was negatively correlated with compatibility, and heterogeneity in the number of hobbies strongly liked, reflecting the importance placed upon hobbies and recreational activities, was negatively correlated with group compatibility. Heterogeneity on scales reflecting autonomy, task orientation, achievement need, nurturance need, and dependency (FIRO-B Wanted Control) were negatively correlated with the compatibility criterion. These results tended to confirm predictions that attitudes and values most relevant to group maintenance or achievement would be most likely to affect compatibility. For example, strong needs for autonomy or independence would seem to be inconsistent with group participation and support of group goals. In summary, results of this study strongly suggested that reducing group heterogeneity on certain need and attitude dimensions would contribute to effective functioning of isolated work groups.

Correlates of Compatibility

Finally, I would like to discuss briefly relationships of a number of other group properties to the group compatibility criterion just described. The group properties considered were severity of station environment, based upon averaged rankings of the stations over four factors (altitude, average annual temperature, months of darkness, and square feet of building space per man), size of station group, and mean scores on three questionnaire scales reflecting formality-informality of leadership, group accomplishment, and average satisfaction of group members with their assignments.

Two administrations of the test scales were available, one from early winter and the other from late winter.

Environmental severity tended to correlate negatively with compatibility, but only the correlation for late winter was significant at the .10 level. Station size was unrelated to group compatibility at either time period. Compatibility was highly correlated with mean group accomplishment scores both early and late winter ($r = .84$ and $r = .88$, respectively). Compatibility also was highly related to satisfaction with assignment of group members on both occasions ($r = .63$ and $r = .59$). Compatibility was not linearly related to the measure of formality-informality or centrality of leadership at either test administration. Subsequent analysis, however, revealed a nonlinear relationship between type of group structure and group compatibility as perceived by group members. Both formal and informal group structures were positively related to group compatibility, but an intermediate level of formality in group structure, perhaps representing ambiguity or inconsistency to station members, was associated with group incompatibility. This relationship was highly consistent for two Navy enlisted occupational groups over various levels of individual dependency need, but the relationship was not present for the civilian group.

The results showed clearly that in Antarctic groups compatibility, productivity, and job satisfaction are highly interrelated. Formality of group structure had a nonlinear relationship with group compatibility; groups which were either clearly formal or informal were more compatible

than groups of apparently ambiguous or inconsistent structure. Other complex relationships, including nonlinear ones, may be expected to emerge from further analyses of the interactions of role, personality, and group attributes in the prediction of group compatibility.